Real-time Signal-to-Noise Ratio Estimation for BPSK and QPSK Modulation

To achieve the clearest digital signal in a phase-modulated communications link, a signal must prevail against such environmental noise as weather interference, antenna misalignment, and transient power loss. An accurate assessment of the signal-to-noise ratio (SNR) enables the sender to adjust the transmission power to ensure that the communication can be completed successfully without using excess energy. Inventors at NASA Glenn Research Center have come up with a method to accurately assess the SNR in real time and eliminate the need for a separate, parallel baseline communication link to monitor the transmission quality. This technology improves the performance and reduces the cost of communications systems.

Benefits

- **Higher energy efficiency.** Needs less power when the SNR is low.

- **Low cost.** Eliminates the separate transmitter/receiver previously needed for the parallel baseline communication link.

- **Widely applicable.** Suitable for any digital communications system that uses M-ary phase-shift modulation; useful for all wireless communication networks; can be extended to include fiber-optic systems.

- **Simpler.** Does not require a specific receiver structure, or pre- or post-processing, and is not limited to a particular modulation.

Technology Details

How It Works

This technology is a statistical characterization of a communication link such as satellite-to-Earth or cell tower-to-cell tower. The statistical methodology provides a diagnostic function and identifies the characteristics of a given type of communication link in relation to the environment in which it operates. A demodulator receives an input signal consisting of the original carrier signal, along with environmental noise. The demodulator breaks down the composite signal into its in-phase and quadrature-phase output components. Both the in-phase and the quad-phase outputs are used to calculate a biased estimate of SNR, using maximum likelihood estimation techniques. The biased estimate then is entered into a look-up table to calculate an unbiased estimate of SNR. The technology is commensurate with the implementation of next-generation tetherless communications systems.

Why It Is Better

The technology is a relatively simple, quick, and inexpensive method to estimate the SNR of digital transmissions. A key advantage of this technology is that it eliminates the need for a separate and parallel baseline communication link to monitor transmission quality. The innovation improves the performance and reduces the cost of communications systems. With an accurate estimate of SNR, the communications system operator will have a reliable indication of the amount of transmission power required to complete clear communication and will be able to adjust the power as needed. This feature saves energy because the signal would not always have to be transmitted at the highest power. It can be run on low power when the SNR is low. As a software/firmware package, the technology is comparatively inexpensive. Added value can be realized by integrating this diagnostic system with control systems to correct physical malfunctions and data errors.

Patents

Patent No. US 7,190,741 B1 was issued March 13, 2007.

Licensing and Partnering Opportunities

NASA invites companies to discuss licensing or partnering opportunities involving this innovative technology for commercial applications.

For More Information

For more information about this and other technology licensing opportunities, please visit:

Technology Transfer and Partnership Office
NASA Glenn Research Center
E-mail: ttp@grc.nasa.gov
Phone: 216-433-3484
http://technology.grc.nasa.gov/